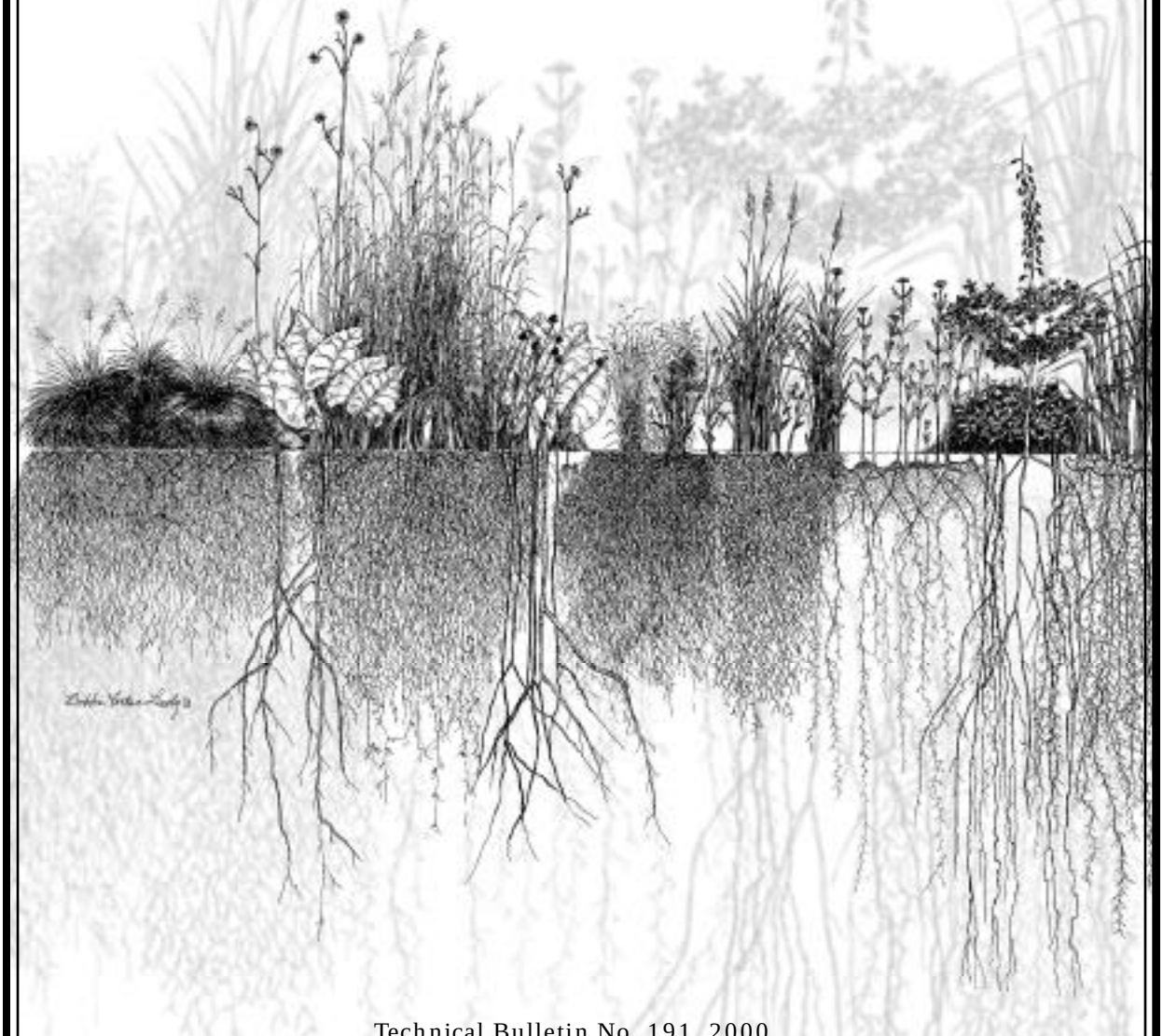
ATLAS *of the* WISCONSIN PRAIRIE *and* SAVANNA FLORA

THEODORE S. COCHRANE AND HUGH H. ILTIS



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Cover: Tallgrass prairie cross section, showing principal grasses and forbs, and extent of root development. Original drawing by Bobbie Lively Diebold.

ABSTRACT

This *Atlas of the Wisconsin Prairie and Savanna Flora* treats most of the native vascular plants of Wisconsin grassland and savanna communities from the standpoints of floristics and phytogeography. Included are 341 species and 73 additional subspecies, varieties, and hybrids (discussed and mapped) as well as 103 species and 50 infraspecific taxa and hybrids (discussed or casually mentioned). Part I discusses the physical geography and climate of Wisconsin; the composition of its prairie, barrens, and savanna communities; and the history of its flora. Part II consists of 354 dot maps showing the exact distributions of the taxa as based on herbarium specimens, each accompanied by a statement describing the plant's habitats, abundance, overall distribution, and geo-floristic affinities. One of the practical uses of this work is to help guide ecologists and conservationists in the planning of prairie restorations.

Key Words:
Wisconsin, prairie, savanna, grassland, plant distribution, restoration, conservation.

UNIVERSITY OF WISCONSIN MADISON 150 YEARS

Atlas of the Wisconsin Prairie and Savanna Flora

Theodore S. Cochrane and Hugh H. Iltis

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PRESENTATION

It is with much pleasure that I see this prairie and savanna atlas come to fruition. This project has developed well beyond its original scope, and the result is a work that will be widely consulted by the many persons and agencies interested in prairie restoration and the Wisconsin flora in general.

This is a notable accomplishment of the University of Wisconsin–Madison Herbarium, officially designated the Wisconsin State Herbarium in 1995. We are now embarking on an era of electronic dissemination of information on the Wisconsin flora. *The Checklist of the Vascular Plants of Wisconsin* (DNR Technical Bulletin 192)was placed online in late summer, 1998 (www.ies.wisc.edu/herbarium/), and this will form the backbone of multiple additions to follow, such as detailed plant distribution maps (including the maps in this publication), photographs of Wisconsin plant species, plant description data, and access to the growing database of the more than 400,000 herbarium specimens housed in different Wisconsin herbaria. This initiative is being coordinated with other universities and museums, the Wisconsin Department of Natural Resources (DNR), and other interested parties. This kind of collaborative effort will provide much valuable information on key aspects of our state's flora.

Paul E. Berry
Director, University of Wisconsin–Madison Herbarium
(The Wisconsin State Herbarium)

FOREWORD

Since the first Midwest Prairie Conference was held in 1968 (which has since evolved into the biennial North American Prairie Conference), there has been a gradual, but steady, increase in the interest of both the general public and government agencies in tallgrass prairie ecology, conservation and restoration. In recent years, this enthusiasm for prairie has spilled over into oak savanna ecosystems as well. The development and popularity of new conferences—the biennial Midwest Oak Savanna Conference, which was first held in Chicago, IL, in 1993, and the North American Savannas and Barrens Conference held in Normal, IL, in 1994—are evidence of this, as is the significant upsurge of interest in private conservation groups and enthusiasm for gardening and landscaping with native plants. Because of the endangered status of both of these ecosystems, many local private conservation groups, as well as state and federal agencies, have made prairie and savanna communities high priority for protection and restoration.

This ***Atlas of the Wisconsin Prairie and Savanna Flora*** is designed to be an information resource for those planning native prairie and oak savanna restorations and plantings in Wisconsin. The dot range maps provided show the known distributions of native plants in our state and will guide you in selecting species most appropriate for given locations. For best results in matching species to a specific site's characteristics, this atlas should be used in conjunction with its companion publication, *Plant Species Composition of Wisconsin Prairies: an Aid to Selecting Species for Plantings and Restorations* (Henderson 1995a, DNR Technical Bulletin No.188).

Restorations (simply "plantings" in most cases) of these communities have become very popular among private landowners for backyards and rural properties, and among public agencies for parks, wildlife areas, roadsides, and school grounds. Over a half-dozen private companies within or very near to Wisconsin's borders are now specializing in prairie and savanna planting, and are doing well. In addition, a state-sponsored prairie seed farm has been established in Illinois, and one is currently being developed in Wisconsin.

Unfortunately, the availability of information on prairies and savannas in Wisconsin has not kept pace with the upwelling of interest and activity in plantings and restorations. One example is the absence of an atlas of Wisconsin Flora. Without readily available distribution information, prairie and savanna species are frequently being planted outside their natural or historic ranges within Wisconsin. The primary purpose of this atlas project, therefore, is to provide the information needed to begin correcting this problem.

Some individuals planning prairie and savanna plantings may not consider the planting of native species outside their natural/historic ranges to be a problem worth worrying about, given that species ranges are not static in nature. We, however, believe it to be a very important consideration that should not be lightly dismissed.

In the absence of major climatic change or dramatic environmental changes, ranges of plant species tend to be rather stable in the context of human lifespans. (Noted exceptions are recent weedy, mostly Eurasian invaders.) Given the relatively stable climate of Wisconsin, prairie and savanna species have had 6,000 or more years following the last glaciation to recolonize and stabilize their distributions in the state. It is unlikely that any of these species would be significantly expanding their ranges in the state in the next 100 years without direct human assistance. Therefore, the distribution data represented here, which cover the past 150 years, are still very pertinent as to the "natural" ranges of these species, and they should not be ignored in planning native prairie and savanna plantings or restorations. To do otherwise will threaten the long-term integrity of the rich regional variation in prairie and savanna community composition that currently exists across Wisconsin, as well as the unique genetic composition of local populations. Ignoring these geographical ranges also increases the risk of future range distribution data becoming contaminated with artificial range expansions, which will compromise the data's usefulness to our attempts at understanding the ecology of these species and the prairie/savanna communities, and also in detecting natural range extensions that may occur with future climatic change.

These range maps were produced by the University of Wisconsin–Madison Herbarium with long-term funding from the UW–Madison Department of Botany, and since 1992 from the DNR's Bureau of Research (now Integrated Science Services), and assistance from the DNR's Bureau of Endangered Resources. They are in the public domain and may be reproduced as long as credit is given to the authors, the UW–Madison Herbarium, and the DNR.

Of course, no atlas is ever complete. Should you find what appears to be a natural population of any of the species covered in this publication that lies outside the distribution shown, please contact the UW–Madison Herbarium so that the range maps can be updated in the future.

Richard A. Henderson
Terrestrial Ecologist and Wildlife and Forestry Researcher, DNR

Prairie is composed of many different species of native American plants. It appears as an inextricable mass of endlessly variable vegetation. One glories in its beauty, its diversity, and the ever changing pattern of its floral arrangements. But he is awed by its immensity, its complexity, and the seeming impossibility of understanding and describing it. After certain principles and facts become clear, however, one comes not only to know and understand the grasslands but also to delight in them and to love them.

J. E. Weaver, 1954
North American Prairie

AUTHORS AND ACKNOWLEDGMENTS

Theodore S. Cochrane has been Herbarium Curator at the University of Wisconsin–Madison since 1970, and received his M.S. in botany there in 1983. His research has focused on the identification and distribution of the Wisconsin flora, especially Cyperaceae and Juncaceae, Neotropical Capparidaceae, and selected series of North American *Carex*. For the past 15 years he has been working with Hugh Iltis and Mexican colleagues of the University of Guadalajara on the flora of the Sierra de Manantlán Biosphere Reserve.

Hugh H. Iltis, born in Brno, Czechoslavakia, has resided in the U.S. since 1939, receiving his Ph.D. from the Missouri Botanical Garden–Washington University, St. Louis, in 1952. Botanist and environmentalist, he has devoted his life to the study of the flora of Wisconsin, the Neotropical species of Capparidaceae, and is co-describer of the fourth known species of *Zea*, namely *Z. diploperennis*, of the Sierra de Manantlán. He thus became godfather to the establishment of the Manantlán Biosphere Reserve, and has long been a strong advocate of what is now known as Biophilia, the gene-based need for contact with nature and natural patterns. Awell-known fighter for nature preservation and population control, Dr. Iltis was a Professor of Botany at the University of Wisconsin–Madison and Director of the Herbarium from 1955 to 1993, where he is now emeritus.

This ***Atlas of the Wisconsin Prairie and Savanna Flora*** was compiled and produced at the University of Wisconsin–Madison Herbarium. It is part of a long-term project to map all the plant species of Wisconsin, a goal supported for some 75 years by the University of Wisconsin–Madison, Department of Botany. The prairie and savanna atlas, specifically, has been supported since its inception in 1992 by the University of Wisconsin–Madison Department of Botany and the Wisconsin Department of Natural Resources, Bureau of Research (now Integrated Science Services). Richard A. Henderson, terrestrial ecologist and wildlife and forestry researcher, conceived the idea of an atlas, provided the impetus by supplying the initial list of species to be included, and arranged for funding to hire mappers. We are most thankful for the assistance of the Department of Botany, its Herbarium, and its Multimedia Facility, in furnishing facilities and work time for the authors and illustrator, Kandis Elliot.

Several Wisconsin herbaria and associated botanists have provided considerable assistance over an extended period of time. We are most grateful to the directors, curators, and staff of the various herbaria for permission to survey their collections. Gary A. Fewless, Robert W. Freckmann, Susan Garrity, Neil A. Harriman, the late Rudy G. Koch, Neil T. Luebke, Katherine D. Rill, Joseph R. Rohrer, and Peter J. Salamun were at all times most gracious in permitting us to invade their respective herbaria while we were working on atlas projects, as was Anita F. Cholewa of the University of Minnesota Herbarium. Some herbaria, especially those of the Milwaukee Public Museum, University of Wisconsin–Eau Claire, and University of Wisconsin–Green Bay, were most accommodating in sending large loans of specimens. Other individuals have contributed significantly to different aspects of the atlas. These include Neil Luebke and Kevin J. Lyman (Milwaukee Public Museum), Gary A. Fewless (University of Wisconsin–Green Bay), Thomas A. Meyer (Wisconsin DNR), and William J. Hess and Kim A. Allen (Morton Arboretum), all of whom cooperated by making data available in electronic form. We thank Freckmann for access to his unpublished distribution maps for *Panicum* and Kelly Kearns for furnishing the list of native plant nurseries reproduced in Appendix B. Kandis Elliot, Department of Botany Senior Artist, redrew the base map, prepared the plant drawings from color transparencies, and electronically designed this book. She and James W. Jaeger converted the original pencil working maps to electronic format.

The maps themselves represent the cumulative efforts of numerous individuals, not all of whom can be mentioned here. The earliest mapping was done by N. C. Fassett and his colleagues and students, who during the period 1929 to 1952 published 37 *Preliminary Reports* and four books on Wisconsin plant families (see Appendix C). These works may be thought of as having an atlas function, for each species within them was accompanied by a dot distribution map based on herbarium specimens, a major innovation for a state flora. Unfortunately, scarcely any of Fassett's Wisconsin manuscript maps have survived. The majority of the maps on hand were made by various undergraduate and graduate students and staff (between 1955 and 1970 under the supervision of Hugh H. Iltis), especially by Stephen Gilson in 1964 and 1965, and (since 1970 under the supervision of Theodore S. Cochrane), especially by Christine Williams, Barbara A. Warnes, and Robert H. Read during 1971 and 1972, and by Cochrane from 1970 to the present, in an attempt to map all Wisconsin specimens at the University of Wisconsin–Madison Herbarium. Intensified mapping, both updating earlier maps and completing new maps, was undertaken during the period 1992 to 1994 specifically for this project by Andrew H. Williams, Quentin J. Carpenter, Kristin E. Westad, Joseph P. LeBouton, and Nicholas I. Hill.

Although we have assumed authorship of this book, we are well aware of the large number of people who have contributed in one way or another to this work, especially those former graduate students and colleagues who are cited as authors in Appendix C, Reports on the Flora of Wisconsin. Their original papers have added immeasurably to the foundation upon which this work rests, as have unpublished studies on Wisconsin Heliantheae by T. Melchert, *Rosa* by W. H. Lewis, Scrophulariaceae by F. S. Crosswhite, and Apiaceae by L. Constance and M. E. Mathias. To them we are indebted, as we are to the many colleagues who have provided or verified identifications for specific families or genera. As with any floristic work, the value of the product is wholly dependent upon accurate determination of the specimens. Both authors are intimately acquainted with the flora of Wisconsin, and one of their major concerns has always been the time-consuming task of verifying the identity of each specimen. Probably the majority of the plants mapped were checked by the authors, but we were fortunate to have had the cooperation of numerous colleagues who, having identified specimens for previous studies, contributed to the accuracy of the atlas. Specialists in certain difficult groups, including G. W. Argus *(Salix)*, R. J. Bayer *(Antennaria)*, H. E. Ballard, Jr. *(Viola)*, W. Dietrich *(Oenothera)*, A. G. Jones *(Aster)*, R. R. Kowal *(Senecio)*, A. F. Cholewa *(Sisyrinchium)*, and R. W. Freckmann *(Panicum)*, have been consulted specifically for this book.

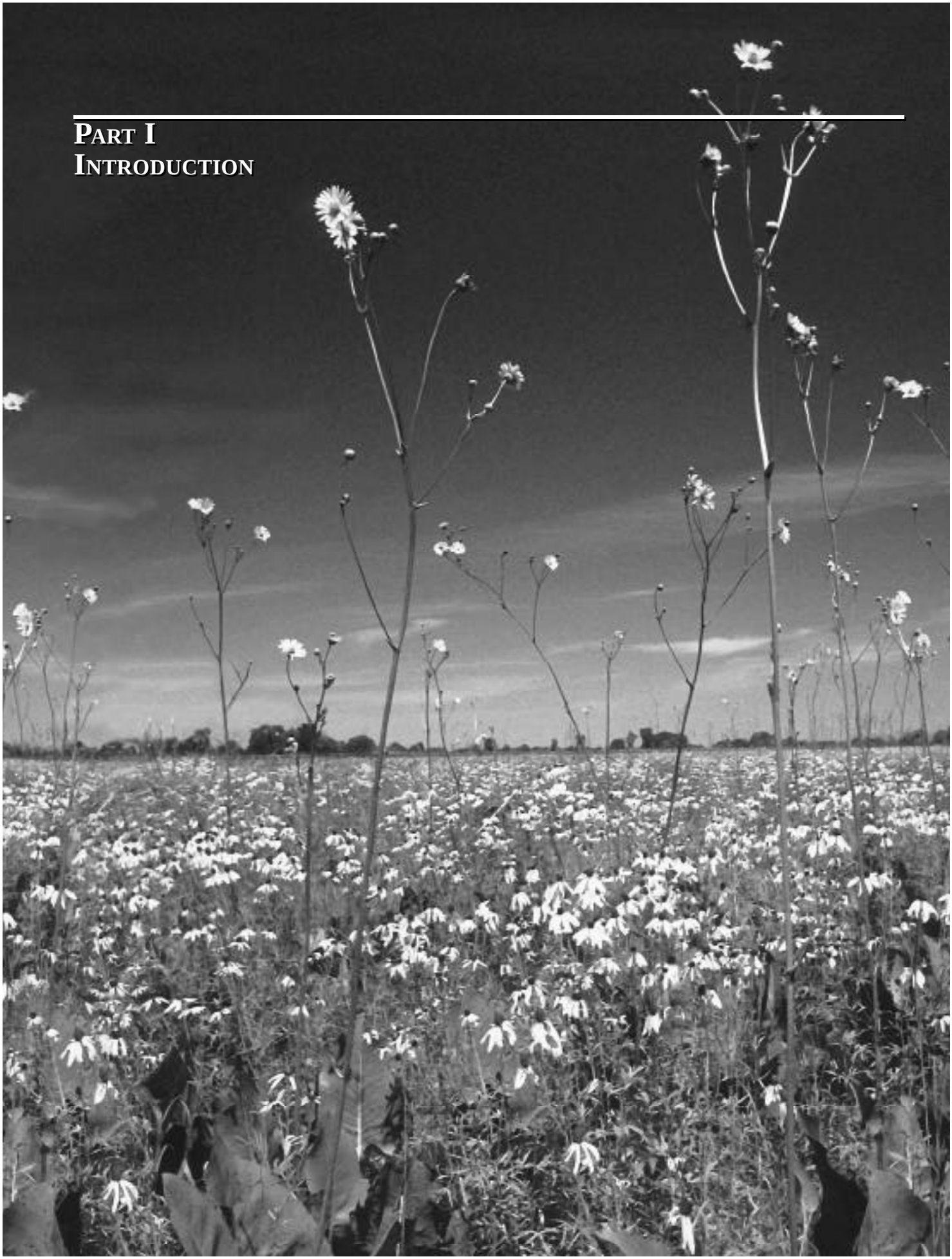
Other people who worked part-time or volunteered to assist on the project include Mark A. Wetter, who double-checked the authorities for plant names, and Merel R. Black, who helped in the search for common names and the compilation of the index. Paul E. Berry read and commented on the introductory text, and Richard A. Henderson reviewed the entire manuscript. Bobbie Lively Diebold granted permission to use the prairie cross section reproduced on the cover. Nancy R. Halliday granted permission to reproduce the prairie gradient illustration (Figure 4). All other illustrations were electronically painted by Kandis Elliot, using 35 mm slides of Wisconsin plants and habitats as reference images. Some of the slides were our own; others were loaned by Kenneth J. Sytsma and Robert R. Kowal. The Part I and Part II openers, which depict two favorite prairies, are by Thomas A. Meyer (Snapper Prairie) and Mark K. Leach (Avoca Prairie and Savanna). Finally, we wish to thank the editorial staff of the Wisconsin DNR, especially Dreux J. Watermolen, Managing Editor at the DNR Bureau of Integrated Science Services, for his assistance in guiding the book through the publication process.

This atlas is based in part upon work supported since 1992 by the Wisconsin Department of Natural Resources. The DNR provided funding for much of the final map production comprising the heart of this volume and helped fund some of the electronic formatting of this book. However, any opinions, conclusions, or recommendations are those of the authors and do not necessarily reflect the views of the Wisconsin DNR.

Snapper (Miller) Prairie State Natural Area, a high-quality lowland remnant in Jefferson County, Wisconsin, is dominated by Big Bluestem, Little Bluestem, and Northern Dropseed grasses. Subordinate to the grasses are many showy prairie forbs, including asters, blazing-stars, and the Yellow Coneflower (drooping rays) and Prairie-dock (very large basal leaves and tall naked stems) evident in this picture. Our Wisconsin deep-soil prairies consist chiefly of tall grasses and tall herbs like these, intermingled with shorter plants that bloom earlier in the season.

Photo by Thomas A. Meyer

Part I
Introduction



INTRODUCTION

This *Atlas of the Wisconsin Prairie and Savanna Flora* is intended to serve anyone interested in the prairies, oak savannas, and oak woodlands of Wisconsin, whether an expert ecologist undertaking the restoration or recovery of a large-scale site, a novice prairie enthusiast contemplating a backyard garden, a professional biogeographer studying plant distributions, or a natural history amateur charmed by prairie flowers. Any one of these should expect to find help in answering two questions: where in Wisconsin does a particular species now grow (or where did it once grow, or did it occur at all?); and what kind of habitat does it prefer? Although the book may assist in the identification of plants, it is not a flora as such; and for that, the user will need to consult other works to confirm identifications (see Appendix C). Its major purpose is to provide distribution maps and habitat descriptions for grassland and savanna plants of the state. The atlas also provides an introduction to the ecology of these communities and supplementary information pertaining to the taxonomy and geography of individual species.

Richard A. Henderson, an authority in the field of prairie and savanna restoration, compiled a list of 289 species that were potential candidates for this book. His approach was entirely restoration oriented, and his choices were influenced by the lists of species presented in Curtis (1959) and plant material offered by wildflower nurseries. Catalogues of native landscapers and nurserymen in the Upper Midwest were also studied. We have excluded eight and added 60 species to make the coverage more comprehensive, and to alert a wide audience to the presence and diversity of the many species contributing to Wisconsin's natural environment. A still larger number of infrequent species, not used by restorationists or of less ecological importance, were omitted. In the transition from savanna to forest there are numerous forest species, as for example Downy Wild-rye (*Elymus villosus*) and Zigzag Goldenrod (*Solidago flexicaulis)* that were not included because they bear little relation to either grasslands or oak openings.

Scope of the Atlas

This work covers vascular plant species that are members of the Wisconsin prairie and savanna biota, including distribution maps and notes on their habitat and frequency. From the standpoint of the Wisconsin DNR, the original purpose was to map only native plant species used by people who protect and/or design and restore prairies and savannas. It follows that the most striking and characteristic wildflowers and grasses of prairie and savanna communities are the ones covered in this book. However, because these richly integrated communities contained many subordinate grass and non-grass species, theatlas also treats some common, though less characteristic species, even if they are not usually planted or sown during a prairie restoration. Not all members of our grassland and savanna flora are covered; many others occur in prairies, savannas, barrens, glades, and other native communities (Table 1). Some of these species are listed in Table 2. Additional lists of characteristic herbaceous and shrubby species associated with prairies and savannas may be found in Curtis (1959), Curtis and Greene (1949), Green (1950),

TABLE 1. Acronyms to native plant communities

The acronyms in this table indicate native plant communtities in which each species was found during Curtis's Plant Ecology Laboratory studies and are compatible with the symbols in his "Species List" (Curtis 1959) and in Table 2.

AQE	Aquatic, Emergent	NDM	Northern Dry-mesic Forest	PW	Prairie, Wet
BF	Boreal Forest	NM	Northern Mesic Forest	PWM	Prairie, Wet-mesic
BG	Bracken Grassland	NS	Northern Sedge Meadow	SB	Sand Barrens
BOG	Open Bog	NWM	Northern Wet-mesic Forest	SC	Shrub Carr
CG	Cedar Glade	OB	Oak Barrens	SD	Southern Dry Forest
CLE	Cliff, Exposed	OO	Oak Opening	SDM	Southern Dry-mesic Forest
CLS	Cliff, Shaded	PB	Pine Barrens	SM	Southern Mesic Forest
DUN	Dune, Lake	PD	Prairie, Dry	SS	Southern Sedge Meadow
FN	Fen	PDM	Prairie, Dry-mesic	SW	Southern Wet Forest
ND	Northern Dry Forest	PM	Prairie, Mesic	SWM	Southern Wet-mesic Forest